

Harsh Maheshwari

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Education

Bachelor of Technology in Electrical Engineering, (Power and Automation) **2015–2019**

Indian Institute of Technology, Delhi, Grade: 8.27/10, Advised by: Prof. Prathosh AP

Publications and Pre-prints

4. **Harsh Maheshwari***, Shreyas Shetty*, Nayana Bannur, Srujana Merugu, "CoSIR: Optimal control of SIR epidemic dynamics by mapping to Lotka-Volterra System", under review at **UAI'21**, presented at **CHIL'21 Workshop** and **ICLR'21 Workshop MLPCP** [preprint: 2020.11.10.20211995]
3. Shreyas S*, **Harsh Maheshwari***, Avijit Saha*, Samik Datta*, Shashank Jain, Disha Makhija, Anuj Nagpal, Sneha Shukla, Suyash S, "Audience Creation for Consumables - Simple and Scalable Precision Merchandising for a Growing Marketplace", under review at **Recsys'21** [preprint: arXiv:2011.08575]
2. Sansiddh Jain, Avtansh Tiwari, Nayana Bannur, Ayush Deva, Siddhant Shingi, Vishwa Shah, Mihir Kulkarni, Namrata Deka, Keshav Ramaswami, Vasudha Khare, **Harsh Maheshwari**, Soma Dhavala, Jithin Sreedharan, Jerome White, Srujana Merugu, Alpan Raval "A Flexible Data- Driven Framework for COVID-19 Case Forecasting Deployed in a Developing- world Public Health Setting", under review at **KDD'21**
1. Nayana Bannur, **Harsh Maheshwari**, Sansiddh Jain, Shreyas Shetty, Srujana Merugu, Alpan Raval, "Adaptive COVID-19 Forecasting via Bayesian Optimization", in **CoDS-COMAD'21** [paper: 10.1145/3430984.3431047]

*Equal Contribution

Work Experience

Data Scientist - Flipkart Internet Private Limited **July, 2019 – Present**

Largest E-Commerce platform in India with over 200M users

Bengaluru, India

- **Complete The Look** (Prof. Niloy Ganguly - IIT KGP, Dr. Arnab Bhattacharya - Flipkart):
 - Generating **fashion-compatible** and **diverse** outfits for a 'hero' product for Indian users and their preferences.
 - Learning compatibility and generating outfits conditioned on 'style'. Two products may be compatible under a certain 'style' and incompatible under another. We are learning the compatibility conditioned on 'style' of an outfit and also generating style-guided outfits.
 - Designed a **beam search** variant using **determinantal point process** to introduce diversity **across outfits** which is important for a e-commerce platform with users having **different preferences**.
 - Implemented SOTA **fashion-compatibility**, **apparel segmentation**, **category classification** models and a flask web tool to get compatibility annotations. (First version to launch soon on the platform)
- **Audience Creation for Consumables** (Samik Datta - Flipkart):
 - *Problem*: Creating an audience set for a store for precision merchandising on Flipkart Grocery home page.
 - Designed a novel kernel to capture periodicity in purchase of grocery items (e.g. sugar) to predict purchase probability.
 - Designed and performed large scale experiments on **temporal point process** based precision merchandising algorithm for Flipkart Grocery. Paper under review at **Recsys'21**
- **Candidate Generation and Ranking** (Samik Datta, Dr. Aditya Rachakonda - Flipkart):
 - Customized **Bayesian Personalised Ranking based Matrix Factorisation** framework for Flipkart homepage recommendation and designed multiple **Lamda MART** & LR based rankers for Flipkart home and product page. (Improvement in overall conversion by 2bps (units/visits) and 16bps (units/visitor))

DSIndiaVsCOVID19

March, 2020 – Present

A consortium of technologists working as volunteers in collaboration with Wadhvani AI to support public authorities in managing the COVID-19 pandemic by building and deploying technology solutions

- **Forecasting** (Dr. Srujana Merugu - Google Research, Dr. Alpan Raval- Wadhvani AI, Dr. Mohit Kumar- Udaan.com):
 - *Problem:* Given the past case counts of an isolated region, forecast the disease spread dynamics for the next k days.
 - Developed a Machine Learning framework for infectious disease forecasting based on **SEIR epidemiological model variants** with parameters estimated via **Bayesian optimization**. The fitted parameters give less than 10% MAPE error on the forecasts for COVID-19 case counts in Indian districts.
 - *Impact:* The system is being used for COVID-19 medical preparedness in war rooms of heavily impacted Indian cities.
- **Controlling an Epidemic** (Dr. Srujana Merugu - Google Research, Wadhvani AI):
 - *Problem:* Given the medical capacity of an isolated region, create a transmission policy schedule to adaptively control the number of infections in an epidemic.
 - Proposed an analytic control framework based on mapping the SIR model to the well studied **Lotka-Volterra** system and **control-Lyapunov** theory. The framework permits design of policies for adaptive control of transmission rate using non-pharmaceutical interventions that limits the overall disease burden.

TA, Machine Intelligence and Learning, IIT Delhi

July, 2018 – Dec, 2018

Prof. Prathosh AP

Delhi, India

- Assisted the professor in designing the course & assignments and grading them for a class of 150 students

Internships

Videoken, Bengaluru (Dr. Meghshyam Prasad)

May, 2018 – July 2018

Computer Vision, Deep Learning

- Constructed a classifier which used patches of images, inspired by **patchGAN's discriminator**, to classify slides from software demo frames in a video by using **spatial pyramidal pooling** to deal with images of different sizes.
- Built an OpenCV based semi-automated image segmentation tool using **Django Framework** to reduce human efforts for annotating images by employing object tracking. Used to create annotated dataset quickly.
- Achieved high **dice coefficient** by training a U-net for segmenting projected slides out of presentation recordings

Projects

BoardSnapped (Prof. Prathosh AP, IIT Delhi)

Dec, 2017 – July, 2018

- Formulated educational video summarization problem as a keyframe detection problem
- Extracted hand-crafted features from Images to perform unsupervised binary clustering using **GMMs**
- Divided the problem into two sub-tasks and solved them using **CNNs** and **bi-directional convolutional LSTM** models
- Achieved classification accuracy of **99.3%** and keyframe detection acc. of **97.38%** with precision & recall of **74%** & **77%**. Received highest grade by the panel.

Skin Segmentation from NIR Images, (Prof. Prathosh AP, IIT Delhi)

Apr, 2018 – Dec, 2018

- To generate skin segmentation dataset for Near Infrared Images trained a **pix2pix** like **conditional GAN** to convert RGB images to NIR images.
- Trained **ResNet38** and **PSPnet** to segment human skin pixels from NIR Images to achieve high dice coefficient.

Advanced Machine Learning [Course], (Prof. Prathosh AP, IIT Delhi)

Jan, 2018 – May, 2018

- **Face Detection and Recognition:** Used **FaceNet** model to achieve an accuracy of **98%**
- **Deep Learning Visualisation** - Visualized representations learned by DNNs through **Saliency maps**, **Occlusion experiments** & **Inverted Image Representations** and performed **Neural Style Transfer**
- **Speech segmentation:** Detected word boundaries in recorded speech using **bi-directional LSTM** on **TIMIT** database
- **Deep Learning framework:** Built a python based framework without using any deep learning library for creating neural networks and trained MNIST digit classifier

Scholastic Achievements

2015: JEE Advanced: Achieved All India Rank of 834 amongst 1.5 million students

2019: Finalist in Flipkart GRiD Among 11 finalist teams in 4-stage National level AI/ML Challenge

2018: Huawei Seeds for the Future: Among **4 students** from India selected for a 2-week training program in **China**, studied Chinese Language and Culture in BLCU, Beijing and picked up hands-on experience of **5G**, **IoT** and **Cloud Computing** in Huawei Headquarters, Shenzhen

2015: NSEP top 1%: Certified for being in **top 1%** out of 37837 in National Standard Examination in Physics (NSEP) organised by Indian Association of Physics Teachers (IAPT)

2014: K.V.P.Y.: Secured All India Rank **59** in prestigious fellowship by IISc after national level exam and interview

Technical Skills and Relevant Courses

Relevant Courses: Introduction to Machine Learning, Advanced Machine Learning, Special Topics in Computers - Computational Learning Theory and Mind, Special Module in Machine Learning - Information bottleneck Theory of Deep Learning, Digital Image Processing, Information Theory, Data Structures and Algorithms, Probability, Linear Algebra

Languages & Frameworks: Python, Java, C++, C; PyTorch, TensorFlow, MATLAB; Keras, Scikit-learn; Hive, SQL

Position of Responsibilities

Secretary, NSS IIT Delhi

Apr, 2017 – Jan, 2018

NSS, IIT Delhi is aimed at motivating students to participate in nation building and social work

- Co-led a team of 4 executives in Animal Care project to conceptualize and organize various sensitizing events in IIT and field trips to animal shelters in **collaboration with an NGO**
- Co-organised NSS orientation for 800+ freshers with a team of 30+ members to introduce NSS

Executive, NSS IIT Delhi

May, 2016 – May, 2017

- Co-organized **free medical camps** for residents in Munirka Slum and **spread awareness** about common diseases and prevention methods in **collaboration with an NGO**
- Co-designed an ALP internship to **study the behavior of the Indian Society** and help reduce electricity wastage in households. Conducted by **100+ volunteers in 50+ cities** spread all over India

Mentor, Student Mentorship Program, IIT Delhi

Apr, 2017 – Apr, 2018

- Guided 4 first year students to ensure smooth transition into IIT Delhi